In Situ Respiration and Direct Enzymatic Assays for Assessing Bioremediation

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Laboratory and field studies of in situ bioremediation at sites contaminated with organics or metals have demonstrated that in situ measurements of respiration using start/stop tests or He tracers combined with direct assays of dehydrogenase activity in the sediment are much more effective in determining the efficacy of the bioremediation strategy being used. Sites with high TOC (> 6000 ppm) can have a low oxygen demand if the carbon present is not bioavailable or is recalcitrant to the indigenous microorganisms, as indicated by both respiration rate and dehydrogenase activity. Addition of surfactants or limiting nutrients at these sites increases both the respiration rate and the dehydrogenase activity resulting in a concomitant decrease in the contaminants of concern (TPH, PAH, TCE, DCE, VC, MSW). Similar studies in the laboratory have shown that reduction of chromium is correlated with increased dehydrogenase activity and not to densities of microorganisms or the presence of particular groups as indicated by molecular probes or fatty acid analyses. In situ respiration tests and direct enzymatic measurements of sediment may provide better control of in situ bioremediation processes by indicating need for addition of nutrients, surfactants, or additional carbon/energy supplements.